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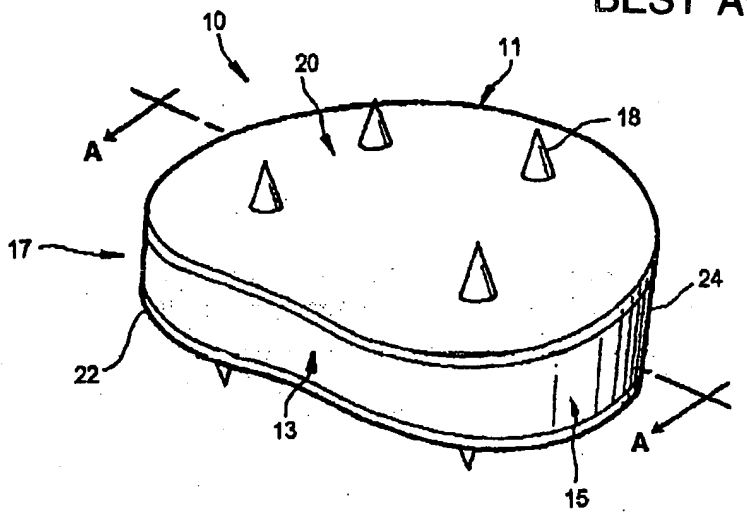
(54) Title: CONTROLLED ARTIFICIAL INTERVERTEBRAL DISC IMPLANT



(57) Abstract: The invention relates to an artificial intervertebral disc for placement between adjacent vertebrae. The artificial intervertebral disc is preferably designed to restore disc height and natural disc curvature, allow for a natural range of motion, absorb shock and provide resistance to motion and axial compression. Furthermore, the intervertebral disc may be used in the cervical, the thoracic, or the lumbar regions of the spine. The artificial intervertebral disc may include either singularly or in combination: an interior including at least one spring member preferably incorporating a arcuate surface member, a flexible core, the flexible core preferably being a slotted core, a ring spring, a winged leaf spring, or a leaf spring, or. The articulating member preferably being attached to one of the endplate by an intermediate shock absorbing element.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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INTERNATIONAL SEARCH REPORT

International Application No
PCTUS 03/25536

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F2/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/11650 A (BRYAN VINCENT ;CONTA BOB (US); KUNZLER ALEX (US); ROULEAU JEFF (US) 14 February 2002 (2002-02-14) claims 1-3,13-15; figures page 18, paragraph 1 - page 21, paragraph 1 page 25, paragraph 3 page 26, paragraph 3	1,2,5, 13,14, 16-28
Y		6-9,11, 51-53, 55,57-69

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 February 2004	07 06. 2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Stach, R

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
/US 03/25536

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/35385 A (DIMSO SA ;GAUCHET FABIEN (FR); LE COUEDIC REGIS (FR)) 22 June 2000 (2000-06-22) claims 1,2,4-6,8; figures 1,2,4-6 page 3, line 14 - line 16 page 7, line 10 - line 19 page 9, line 33 - page 10, line 2	1-3,5,6, 13,14, 17,18, 20,21, 23-27
A		7,8,11, 51,52, 55, 58-62, 64,65, 67,68
X	DE 90 00 094 U (MECRON MEDIZINISCHE PRODUKTE GMBH) 31 January 1991 (1991-01-31) figure page 6, line 5 - line 26 page 8, line 18 - line 24 page 9, line 18 - line 30	1,2,4-6, 12-14, 17,24, 25,27
A		51-54, 58,65-68
Y	WO 01/64140 A (BUHLER MARKUS ;RAMADAN AYMEN (CH); SCIENT X (FR)) 7 September 2001 (2001-09-07) claims 1,2,6,12,13; figures page 6, line 14 - line 17	51-53, 55,57-69
A		1-3,24, 26-28
Y	US 5 674 294 A (BAINVILLE DANIEL ET AL) 7 October 1997 (1997-10-07) claims 1,3; figures 2,3 column 3, line 12 - column 4, line 37	6-9,11
A		1-3,10, 14,16, 17,24, 26,27
A	EP 0 356 112 A (UNIV NEW JERSEY MED ;UNIV RUTGERS (US); JOHNSON & JOHNSON ORTHOPAE) 28 February 1990 (1990-02-28) claims 1-4,6-10; figures 1-3	1,6-9, 11,24, 26,27
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INTERNATIONAL SEARCH REPORT

PCT/US 03/25536

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-28, 51-69

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-28,51-69

An intervertebral disc comprising:
an upper endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a membrane extending between the upper endplate and the lower endplate; and
at least one resilient member disposed between the upper and lower endplates; the resilient member associated with at least one arcuate surface member configured to articulate within at least one socket associated with at least one of the endplates.
(problem: providing an intervertebral implant being able to absorb shocks and to allow articulation of its endplates with respect to each other)

1.1. claims: 51-69

An intervertebral disc comprising: an upper endplate having a first inner surface and a first outer surface, a lower endplate having a second inner surface and a second outer surface, a membrane extending between the upper endplate and the lower endplate; and an articulating member disposed between the upper and lower endplates; the the articulating member having a first and second surface being configured to mate with the inner surface of at least one of the endplate and a shock absorbing element disposed between the second surface and one of the endplates.

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2. claims: 70-86

An intervertebral disc comprising:
a first endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a slotted core disposed between the first and second endplates, the slotted core having a first and second surface, the first surface configured to mate with a pocket formed on the inner surface of first endplate, and the second surface comprising an articulating surface configured to mate with a corresponding surface associated with the second endplate.
(problem: allowing different regions of the core / the implant to compress different amounts depending on the location and type of spinal loading)

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3. claims: 87-107

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

An intervertebral disc comprising:
a first endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a cap having a top surface and bottom surface; the top surface being configured to mate with the inner surface of the first endplate; and
a ring spring disposed between the bottom surface of the cap and the inner surface of the second endplate.
(problem: providing a durable shock absorbing element for a disc implant having the characteristical shock absorption and compression resistance of a spinal disc)

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4. claims: 29-50

An intervertebral disc comprising:
a first endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a membrane extending between the upper endplate and the lower endplate; and
at least one leaf spring disposed between the endplates, the leaf spring having first and second ends, the first end attached to the first endplate and the second end configured to be movable laterally along the inner surface of the first endplate in response to a force on the leaf spring.
(problem: providing a greater range of flexibility of leaf springs in spinal disc implants)

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5. claims: 108-126

An intervertebral disc comprising:
a first endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a leaf spring having first and second resilient ends, configured to engage the second endplate, and a length, the leaf spring further comprising a central body having first and second surfaces, the first surface comprising an articulating surface.
(problem: preventing failure of a leaf spring in a disc implant)

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6. claims: 127-148

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

An intervertebral disc comprising:
a first endplate having a first inner surface and a first outer surface,
a lower endplate having a second inner surface and a second outer surface,
a first articulation member having a first surface associated with the first endplate,
a leaf spring having at least a first surface associated with the second endplate and a second surface associated with a second surface of the first articulation member,
wherein the first articulation member is configured to allow the first and second endplates to articulate with respect to each other, and the leaf spring is configured to allow the end plates to approach one another in response to a compressive force applied to at least one of the end plates.
(problem: providing the surgeon with a greater flexibility in selecting the appropriate material for the articulating surface while not affecting the materials of the endplates)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/25536

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